Speaker: Alejandro Contreras (University of Guadalajara)

Title: Normal quantum channels and Markovian correlated two-qubit errors

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Normal quantum channels and Markovian correlated two-qubit errors

We study general ``normally" distributed random unitary transformations. These distributions can be defined in terms of a diffusive random walk in the respective group manifold, formally underpinned by the concept of infinite divisibility. On the one hand, a normal distribution induces a unital quantum channel. On the other hand, the diffusive random walk defines a unital quantum process, which can be generated by a Lindblad master equation. In the single qubit case, we show that it is possible to find different distributions which induce the same quantum channel.

In the case of two qubits, the normal quantum channels, i.e. quantum channels induced by normal distributions in ${\rm SU}(2)\otimes{\rm SU}(2)$ provide an appropriate framework for modeling correlated quantum errors. In contrast to correlated Pauli errors, for instance, they conserve their Markovianity, and they lead to very different results in error correcting codes or entanglement distillation. We expect our work to find applications in the tomography and modeling of one- and two-qubit errors in current quantum computer platforms, but also in the distillation of Bell pairs across imperfect communication channels, where it is conceivable that subsequently transmitted qubits are subject to correlated errors.